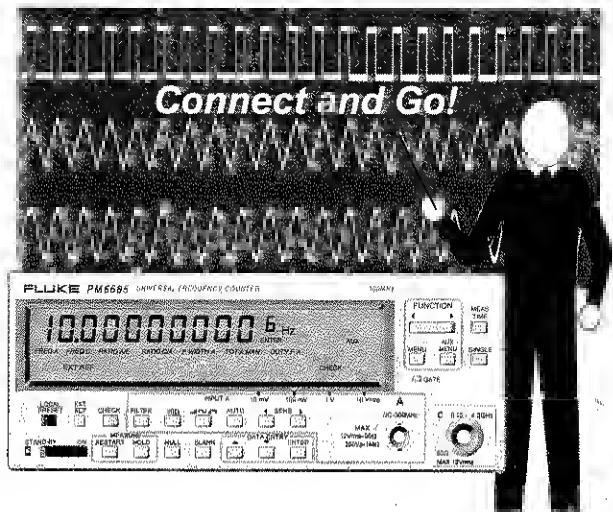


# Programmable Frequency Counter

PM 685 & PM6685R

*Getting Started*



**FLUKE.**

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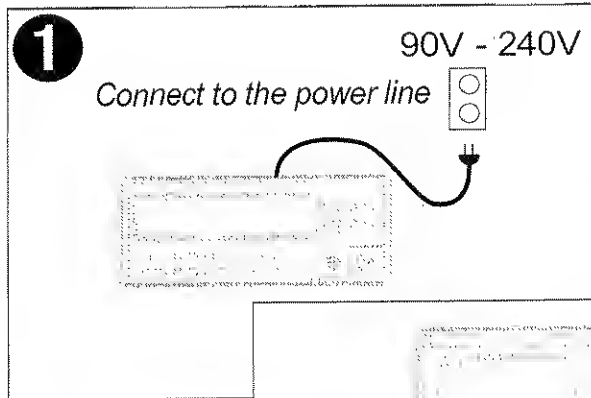
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## Introduction

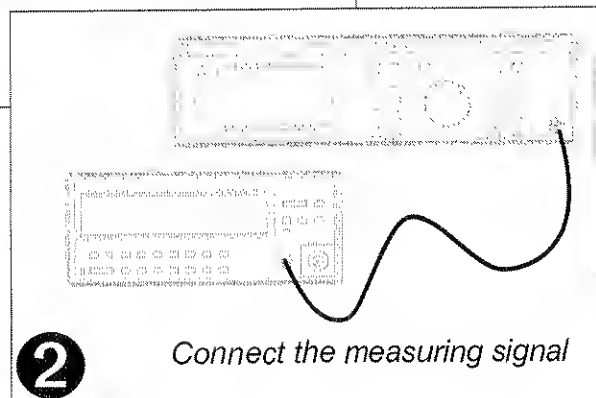
The PM6685 and PM6685R are powerful frequency counters, yet easier to use. The difference between the models is that the PM6685R includes a Rubidium timebase oscillator, an extremely accurate "atomic clock". The PM6685R is housed in a bigger cabinet than PM6685, but the operations of both instruments are identical. This manual gives a brief description of some functions and keys of your new instrument, to get you started.

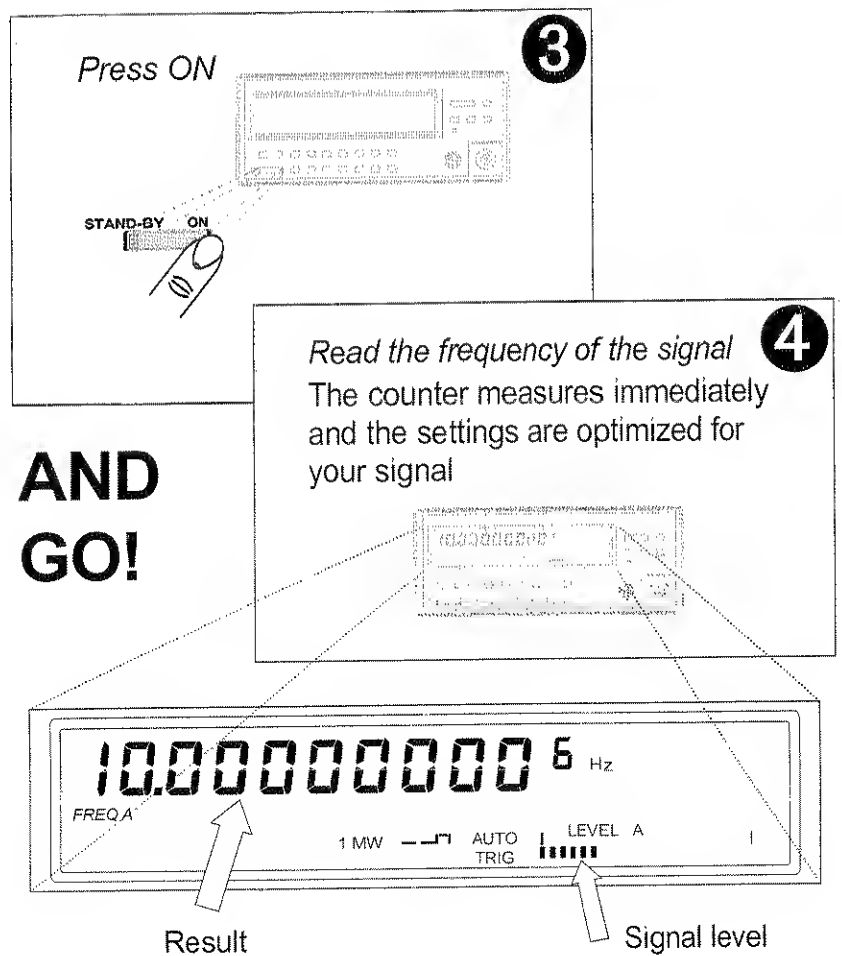
### Frequency Measurements, the easy way!

Making measurements is very easy, just connect and go!



**JUST  
CONNECT**





Continue to read and exercise if you want to know more about the possibilities with this PM6685, 300 MHz. Frequency Counter. The 15 to 25 minutes it takes are well spent. When you want deeper knowledge, the Operators Manual is there to help you.

## Getting Familiar with the Front Panel

You will reach most of the powerful features of the frequency counter by pressing a key. Look at the picture below and you will find the logic of the front panel.

**FUNCTION SELECTION**

The **FUNCTION** rocker key scrolls left or right through the measuring functions.

The **MENU** key turns on all function indicators on the front panel. (Some people find it easier to use it this way).

The **AUX MENU** key lets you access additional advanced functions.

**MEASURING TIME**

Controls the rate and resolution of measurements.

**INPUT SETTING KEYS**

Use these keys to set the impedance, trigger level or sensitivity for the A input, or to select a lowpass filter. The current state of each setting is shown on the display right above the corresponding key. The C input is fully automatic and no settings are required.

**AUTO KEY**

A press on the **AUTO** key turns on the AUTO function. It will optimize the input settings for almost every measurement.

**DATA ENTRY KEYS**

Use these keys to increase or decrease values for measuring time, constants, etc. Press the **ENTER** key to confirm selections you've made.

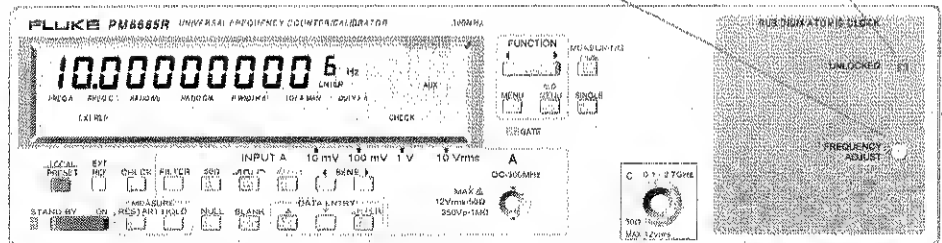
## What's new on the PM6685R front panel?

### Frequency adjust trimmer

Turn this trimmer to adjust the internal timebase. This trimmer should be covered with a temper proof calibration seal.

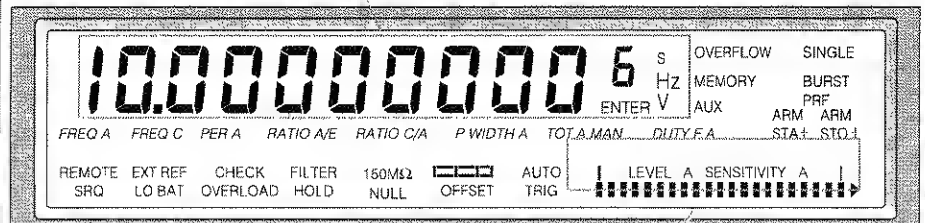
### Unlock indicator

Is lit during approx 5 minutes after power on. When the indicator LED is switched OFF, the unit is operatable



### MEASURED VALUE

The measured value is displayed with ten big clear digits



### BAR GRAPH INDICATOR FOR INPUT LEVEL OR SENSITIVITY

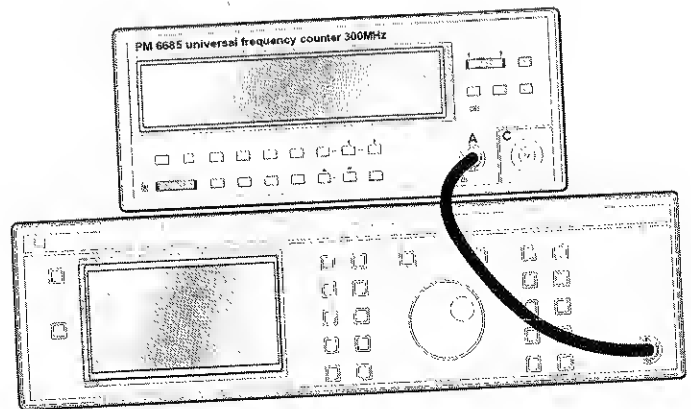
The bar graph on the display shows the signal level or sensitivity. When AUTO is enabled the bar graph shows the signal level and when disabled it shows the sensitivity.

The display on PM6685/pm6685R.

## Exercises

It is much more fun to push buttons if you have a signal to measure. You can either press the **CHECK** key to make the counter measure on the internal 10 MHz signal, or connect a Function Generator, for example PM5139, via a BNC cable. We recommend that you use a function generator and set it up according to the following table. You will be prompted to change settings when necessary to try new functions.

Set up the Generator:	Frequency:	12 kHz
	Waveform:	Square
	Symmetry:	50%
	Amplitude:	2-5 V



A hand in the margin points out the exercises.

### Basic Startup of the Counter

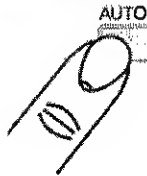
Starting from a known state is always easier. To do so, just turn the power off and then on again. Pressing **LOCAL/PRESET** and then **ENTER** also recalls the default settings.

## Measuring

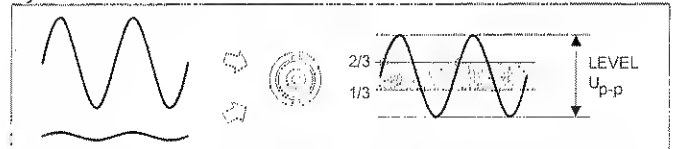
Connect the output of the generator to input A of the counter and you will immediately see the measured frequency on the display. Note the high resolution. Nine digits are displayed in a measuring time of only 200 ms. The following section is a short description on how to use the keys and the functions for setting the input.

### Input settings

#### ● AUTO function

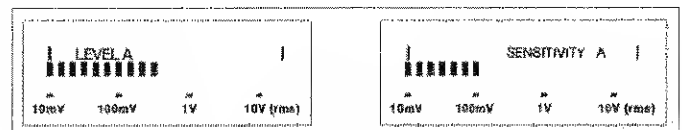


The built-in AUTO function makes the use of PM6685 easy. The peak to peak voltage is measured and Auto sets the hysteresis band between 1/3 and 2/3.



You'll soon find that it's much easier, and more accurate to measure with the AUTO function on, than to do manual settings. There are just a few exceptions that needs manual settings - AM-modulated signals, extremely noisy signals, non-repetitive signals, and signals with frequencies below 50 Hz.

### Level meter



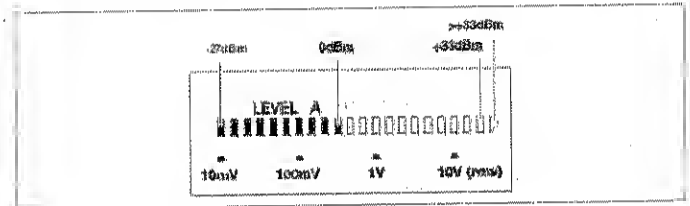
The bar graph scale has two functions: It shows the input level when AUTO is on, and the sensitivity setting when AUTO is turned off.

A scale in Vrms is printed on the front panel. One step on the scale equals 3dB.



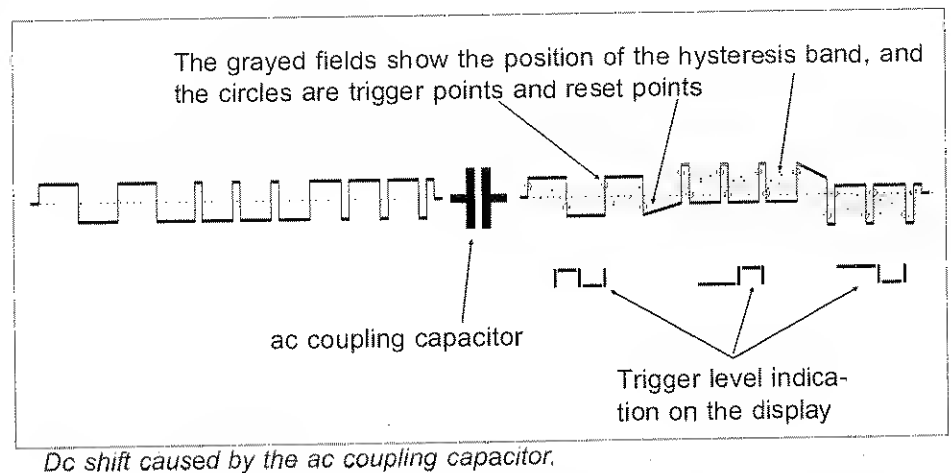


Vary the signal amplitude and watch the bar graph change. The following figure illustrates the trigger level or sensitivity expressed in dBm.



### Waveform compensation and indication

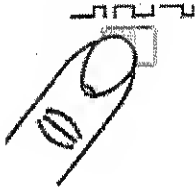
If you want to measure non-symmetrical signals, many other counters will not trig. The reason for this is that non-symmetrical signals do not center on 0V, but they get a dc shift after the ac coupling capacitor. When the duty factor exceeds a certain factor, the input will stop triggering unless the trigger window is offset to compensate for the dc shift of the signal.



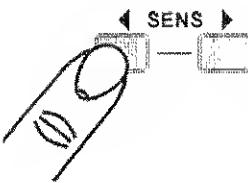
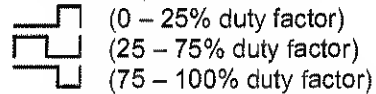
Set the symmetry on the generator to about 10% and note that the waveform segment on the display changes. The input detects the duty cycle change and compensate for the

new waveform. Set the symmetry to the extreme opposite, 99%, and note that the counter still counts.

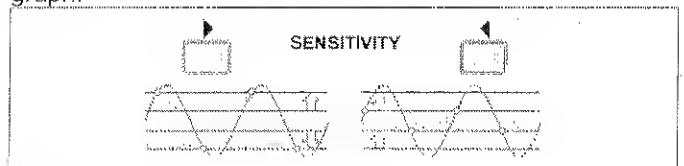
● **Manual setting**



Press the **Waveform** key once to turn off AUTO and return to the last manual settings. Press the **Waveform** key again to select between the three waveform compensations.



Use the **SENS** keys to adjust the input sensitivity. You can read the current sensitivity setting on the bar graph.



Turn on AUTO, and then turn it off again by pressing one of the **SENS** keys. This way you freeze the current waveform selection and sensitivity selected by AUTO. Pressing **SENS** again will increase/decrease the sensitivity around the frozen waveform compensation.

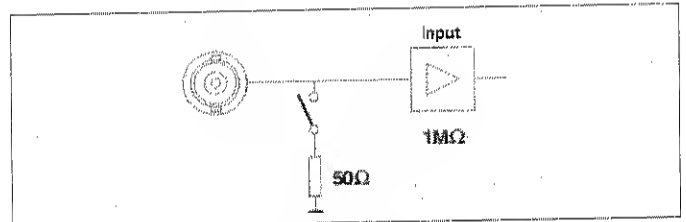
When measuring frequency AUTO sets the sensitivity to 1/3 of the input signal level, to reject noise. When measuring pulse width, AUTO sets the sensitivity as high as possible to reduce trigger errors.



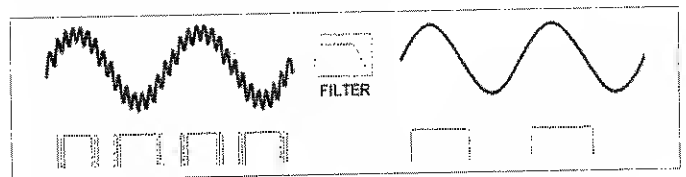
Lets check that by turning Auto setting to manual setting.

- Set the generator to 12 kHz sine wave and 3 Vrms (9 Vp-p) output and apply the signal to Input A.
- Select Frequency and AUTO function on the counter. Notice the signal level on the bar graph.

- Press once on either of the **SENS** keys and notice on the bar graph that auto has selected 1 Vrms as sensitivity (1/3 of the amplitude).
- Now select Pulse Width and turn on the AUTO function on the counter.
- Press either of the **SENS** keys and notice the high sensitivity (10 mv) on the bar graph.



Press the **50Ω** key to toggle between **50Ω** and **1MΩ** termination on input A. Your selection is shown on the display. If the counter refuses to switch to **50Ω**, the input signal is above the safe limit of 12 Vrms.



Press the **FILTER** key to toggle the built-in 100 kHz LP filter. The filter segment is on when the filter is being used.

## Trying the Front Panel keys

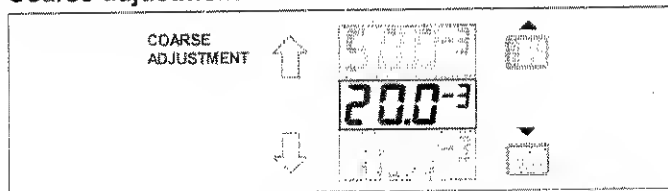
On the following pages you will find a short description on some keys and functions that you will find on the PM6685. Try them and watch the display when you are using them.

### ● Changing Numerical Values

Numerical values, such as Measuring Time, Synchronizing Delay, Nulling reference value etc., can be changed in two ways:

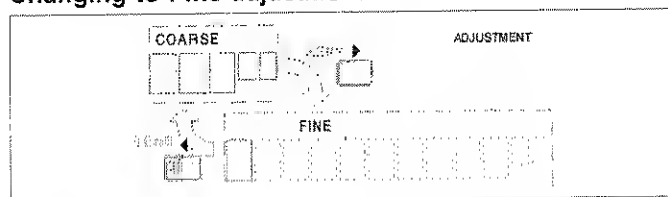
- in steps of 1-2-5 with coarse adjustment,
- or digit by digit with fine adjustment.

#### Coarse adjustment



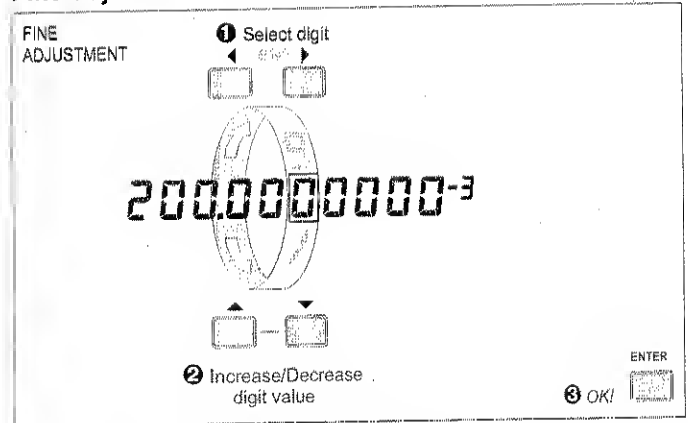
Use the **FUNCTION** rocker key or the **DATA ENTRY** keys to step up or down in steps of 1-2-5, then confirm your selection with **ENTER**.

#### Changing to Fine adjustment



Press the **SENS ►** key to enter fine adjustment. To return to coarse adjustment, push the cursor out of the display, to the left using the **◀SENS** key.

## Fine adjustment

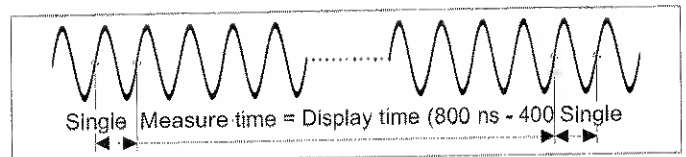
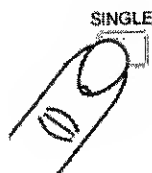


Press the right or left **SENS** arrow key to select the digit you want to change, and then press the **DATA ENTRY** keys to change the digit value.

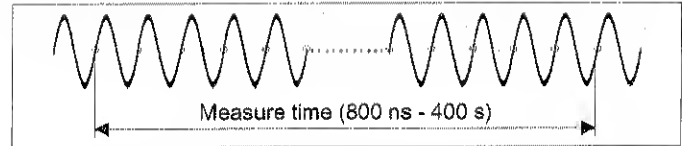


The measuring time decides the resolution in the measurement. Increasing the measuring time gives more digits. Press the **MEAS TIME** key and use the **FUNCTION** rocker key to change the measuring time in steps of 1-2-5 as coarse adjustment. Press the **MEAS TIME** key again to return to measuring.

The measuring time can also be fine adjusted, as described above.



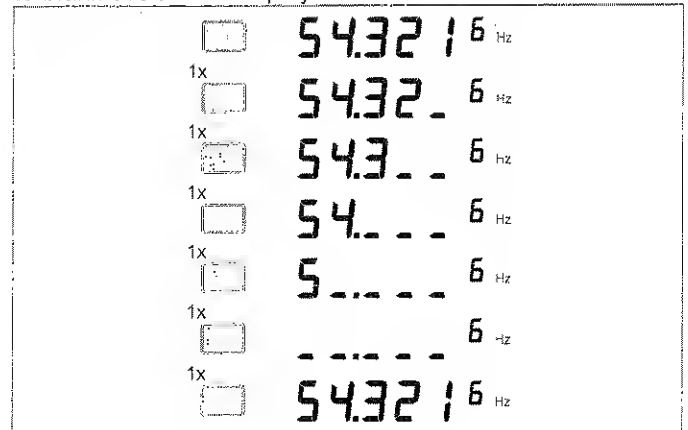
Turn on **SINGLE**. The result is now from a single measurement cycle, and the "measuring time" becomes display time (time between measurements). This gives fast measurements with low resolution.



Turn off **SINGLE** and the counter averages all data captured during the set measuring time, giving higher resolution in the result.

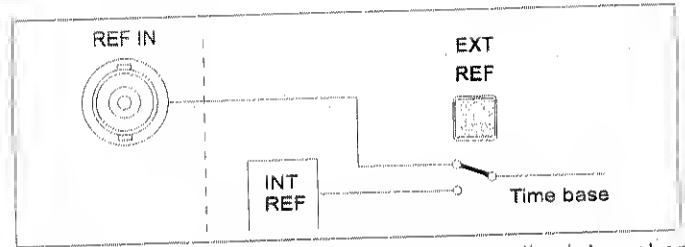
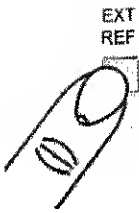
NOTE: Prescalers affect the number of input cycles in a single cycle measurement, see Operators Manual.

Press the **BLANK DIGITS** key once for each digit you want to blank out on the display.

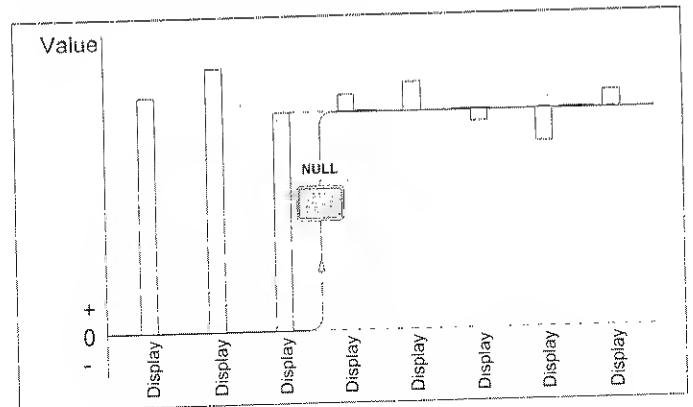


The **CHECK** key enables a self-test of the measuring functions. Press the **CHECK** key to connect internally the 10 MHz reference signal to the logic circuit. Press the **FUNCTION** rocker key to scroll through all measuring functions.

Note that if you select **FREQ C** when check is on, the most significant digits show the prescaling factor of the optional C input (16, 32 or 256).

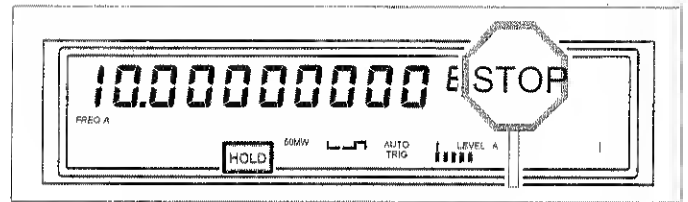


Press the **EXT REF** key to toggle between the internal or external 10 MHz time-base. Since no reference signal is connected the display will show 0:



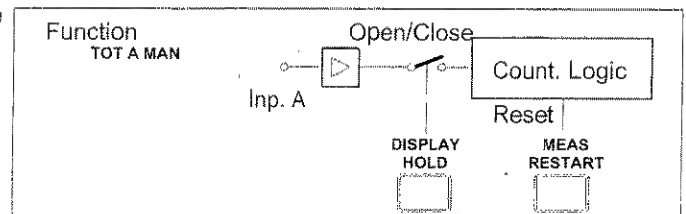
Press the **NULL** key to store the current result as a constant, and switch on the nulling function. The counter will now show the results as a deviation from the stored constant.

Read about how to change the null value via the AUX MENU, on page 17 in this manual.



Press the **DISPLAY HOLD** key to hold the current readout on the display. Press again to continue to measure. When **DISPLAY HOLD** is active, a new measurement is made each time you press **RESTART**.

#### ● **TOTALize A MANUAL**



This function lets you totalize (count) the number of trigger events on channel A. Use the **DISPL HOLD** key to start and stop totalization, and the **MEAS RESTART** key to reset the displayed result.



Try using the counter as a stopwatch:

- Turn on **CHECK**
- Select **TOT A MAN** using the **FUNCTION** key
- Press **DISPL HOLD** to start the stopwatch

The counter will now count to 10000000 in one second.

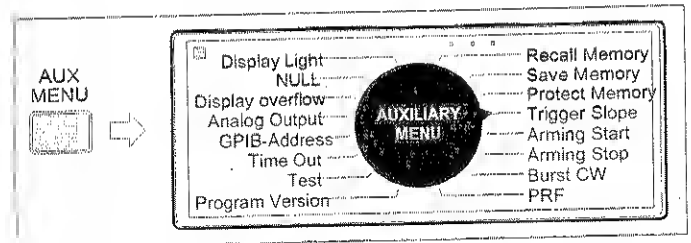
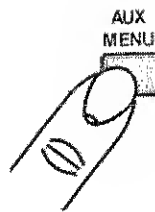
- Press **DISPL HOLD** to stop the stopwatch

Divide the reading with 10000000, and you will get the elapsed time in seconds.



## AUX MENU

The AUX MENU contains a collection of useful, but less frequently used functions. Here you will try some of the functions, the rest you will find described in the Operators Manual.

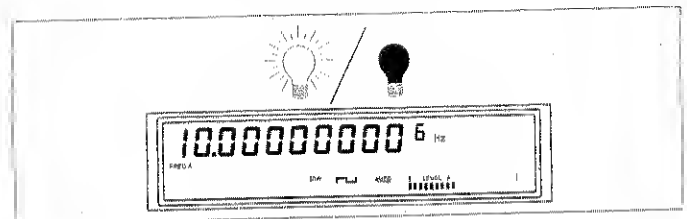


Regard the AUX MENU as a rotary switch. Press the **AUX MENU** key and then use the **FUNCTION** rocker to "turn" the rotary switch. When the display shows the function you want, confirm your selection by pressing **ENTER** key. To escape without selecting any auxiliary function, press the **MEAS RESTART** key.

Some selections will take you to a submenu with more selections or parameter settings.

### Display Backlight

You can turn the backlight on or off in the AUX MENU. This is useful when the instrument is powered from battery.

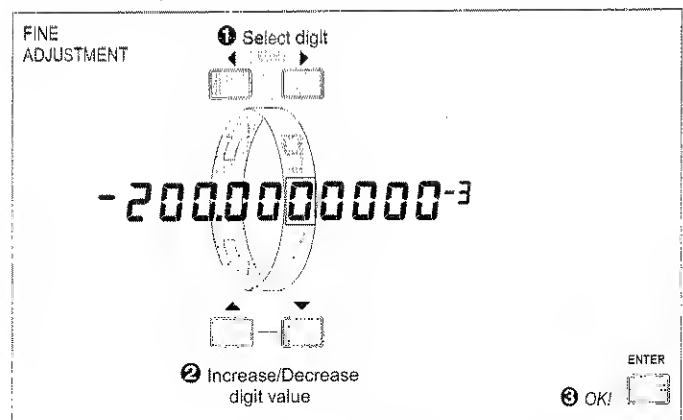


## NULL

You press the **NULL** key to store the last measured value and display the following results as a deviation from this value. If NULL is on, you switch it off with the NULL key.

You press the **AUX MENU** key and select NULL to change this value, or to switch on the NULL function without changing the stored value.

- Press the **AUX MENU** key and use the **DATA ENTRY** keys to select NULL, and press **ENTER**.
- You can now see the value stored by the **NULL** key, press **ENTER** if you want to switch on nulling with this value.

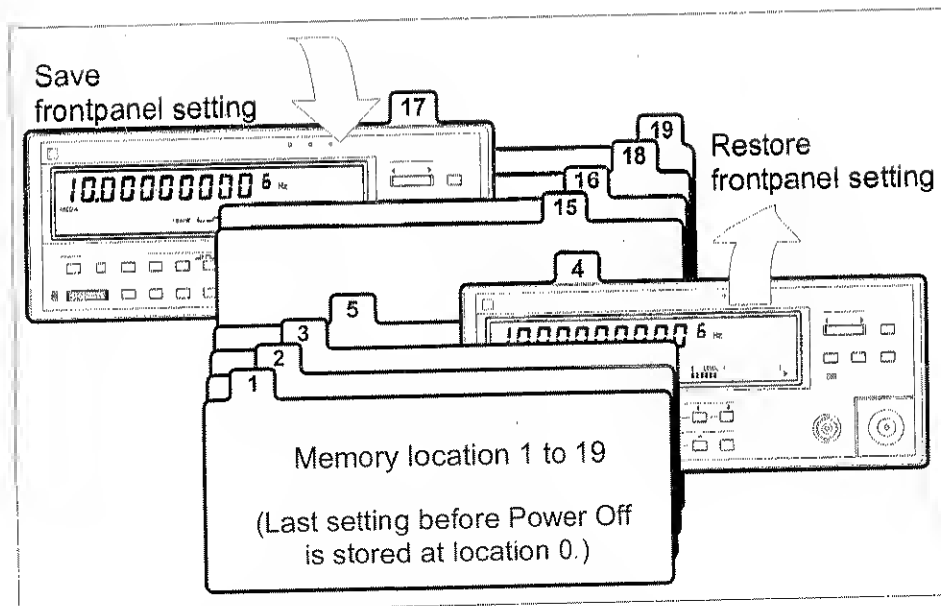


- To change the value, press the **SENS** arrow keys to select *position* for fine adjustment.
- Press the **DATA ENTRY** keys to change *digit value*.
- Confirm changes with **ENTER**, or escape without changing the nulling value by pressing the **MEAS RESTART** key.

You can also use coarse adjustment to change the value. Position the cursor in the leftmost position and press the left **SENS** arrow key to enter coarse adjustment. Pressing either of the **DATA ENTRY** keys to change value in 1-2-5 steps.

## Save

You can store a front panel setting in one of 19 memories.



Select measuring function Period A and store it in memory 4.



Press the **AUX MENU** key to enter the menu.

- Press the **DATA ENTRY** keys to select **SAVE**.
- Press the **ENTER** key.
- Select a number for Memory (for example 4) by pressing the **DATA ENTRY** arrow keys.
- Confirm with **ENTER**.

---

Your front panel setting is now stored in memory 4.

### ***Recall***

Now we want to recall the setting stored in memory 4, but first you have to change some settings, for example:

- Press the **LOCAL/PRESET** key followed by the **ENTER** key to preset the counter. Check that the counter is set for another measuring function, **FREQ A** instead of **PER A**.

To recall the front panel setting with the **PER A** measuring function.

- Press the **AUX MENU** key to enter the menu.
- Press the **DATA ENTRY** keys to select **RECALL**.
- Press the **ENTER** key.
- Select a number to recall (in this example 4) by pressing the **DATA ENTRY** arrow keys.
- Confirm with the **ENTER** key.

The stored front panel setting is now recalled and the memory annunciator is shown on the display.

- Press **STAND-BY** to turn off the counter.
- Press **ON** to turn it on again

Note that the memory annunciator is on, if you turn off the counter when a memory setting is active, the counter automatically recalls that memory at power on instead of starting with its default settings.

### **● *Last setting before switch off***

Perhaps you by accident turned off the instrument, or wants to continue a measurement the following day?

Then, you can return to the last setting before power off, by recalling memory number 0.

---

## ***Is it really this easy?***

Now you are pretty familiar with the main functions of the PM6685, but don't stop here. Pick up the operators and programming manuals and continue to dig into the many features.

You will find lots of interesting, timesaving and valuable functions!